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5. A demonstration that the Total Dissolved Solids ("TDS") content of the water in the aquifers is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.

#### GENERAL INFORMATION

##### I. Map of the area for which exemption is requested.

A map of the area for which exemption is requested is submitted as Attachment I to this letter. The three areas for which exemption is requested are shaded green, red and diagonally lined.

##### II. Written description of the aquifers or formations for which exemption is requested:

###### A. Name of formation or aquifer:

###### "Z-Sand"

The aquifer is a previously unnamed sandstone in the Buck Creek Formation of the Wabaunsee Group in the Pennsylvania series. This sandstone occurs approximately 10 feet below the Bird Creek Limestone member of the Wabaunsee Group.

The name "Z-Sand" was applied for identification purposes to this sandstone by Phillips' log analysis and engineering personnel in their efforts to locate and define the base of fresh water in the area beginning in late 1984.

###### "Happy Hollow"

The "Happy Hollow" is a limestone, in the Buck Creek Formation, of the Wabaunsee Group in the Pennsylvania series. This formation occurs approximately 60 feet above the Bird Creek Limestone member of the Wabaunsee Group. A portion of this formation, and a portion of the "Z-Sand" are the subjects of this exemption request, and will be referred to as the "Happy Hollow", "Z-Sand", or "Z-Sand"/"Happy Hollow", henceforth in this request.

###### B. Subsurface depth or elevation of zones:

The subsurface elevation of the "Z-Sand" is detailed in Attachment II, a map depicting the structure on top of the "Z-Sand", with a datum of sea level.

The subsurface elevation of the "Happy Hollow" is approximately 100 feet above the top of the "Z-Sand" in Area A, shown in Attachment I.

C. Vertical confinement from other underground sources of drinking water:

The first step in determining vertical confinement from other underground sources of drinking water is to determine the location of any other USDW's.

Aquifers in an interval between a horizon uniformly 100 feet below the surface and the base of the geologic horizon identified as the "Z-Sand" were assessed to determine the status of these aquifers as USDW's. TDS estimates of the water contained in the aquifers have been made using EPA's definition of fresh (treatable) water and evaluation of the spontaneous potential ("SP") response of these zones as shown on electric logs of a number of individual wells spaced across the area for which the exemption is requested.

Based on this review, Phillips concludes that in the area for which the exemption is requested, there are no USDW's below the horizon which runs uniformly 100 feet below the surface and above the top of the "Z-Sand", except for that portion of the "Happy Hollow" limestone shown in Attachment I as Area A. Area A is also the subject of this aquifer exemption request. For the purpose of establishing vertical confinement, note that the top of the "Happy Hollow" is within 100 feet above the top of the "Z-Sand". Also, the location of the "Happy Hollow" with respect to significant intervening shale layers and assumed other underground sources of drinking water, is the same as that of the "Z-Sand".

Note: The nominal minimum surface casing base is 100 feet below the surface. Also, note: Use of the SP response to evaluate zones within 100 feet of the surface is not possible due to interference from the surface casing.

While, as stated in Phillips' October 2, 1987, letter to the Regional Administrator, "whether there is a USDW within. . . SBU is problematic;" for purposes of this Aquifer Exemption Request, the base of a horizon uniformly 100 feet below the surface will be assumed to be the nearest "other underground source of drinking water." To depict this horizon on a consistent basis,



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Attachment I-A shows this feature extended through the aquifer exemption area, in terms of an isopleth, with units of "feet above mean sea level".

Given this assumed location for the nearest other underground source of drinking water, vertical confinement between the base of this horizon and the top of the "Z-Sand" ranges from approximately 360 to 500 feet.

Except in wellbores, confinement between these zones is provided by several shale beds of various thicknesses; the most significant of these being:

<u>SHALE</u>	<u>CUMULATIVE THICKNESS</u>
Silver Lake Shale	30 feet
Auburn Shale	40 to 60 feet
Langdon Shale	55 to 60 feet
Total	125 to 150 feet

For a description of the methods used to arrive at the TDS estimates of the water contained in aquifers, refer to the "Electric Log Survey" which was transmitted to EPA as Attachment IV to Phillips' letter to the Region VI Administration dated October 2, 1987. A copy of this same "Electric Log Survey" is transmitted with this request as Attachment III.

D. Thickness of proposed exempted aquifers:

"Z-Sand"

The "Z-Sand" ranges from 40 feet to 60 feet in thickness over the area in question. The most typical thickness is 55 feet.

"Happy Hollow"

The "Happy Hollow" limestone ranges from 8 feet to 30 feet in thickness over the area in question.

E. Area of exemption:

The size of area for which exemption is requested is approximately 13,760 acres (Area A - 3,520 acres; Area B - 9,600 acres; diagonally lined four quarter sections - 640 acres).

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## F. Water quality analysis of the horizon to be exempted:

1. The most encompassing information available about the quality of the water in the "Z-Sand" and the "Happy Hollow" is gained from calculating the salinity of the water utilizing the SP curve from electric logs as described in C., above. The results of these calculations for the wells inside the area that have electric logs are as follows:

## AREA A

<u>WELL</u>	<u>WATER QUALITY (TDS,PPM)</u>	
	<u>HAPPY HOLLOW</u>	<u>Z-SAND</u>
NBU 113-6A	8,741	22,420
NBU 114-W11	9,302	28,068
NBU 114-3A	11,321	24,208
NBU 114-W7A	11,829	16,993
NBU 113 W7A	9,736	37,245

## AREA B

<u>WELL</u>	<u>"Z-SAND" WATER QUALITY (TDS,PPM)</u>
SBU C-06	8676
SBU E-07	57367
SBU E-08	9007
SBU H-10	11535
SBU F-05	3670
SBU F-06	10224
SBU J-16	10394
SBU L-03	4129
SBU M-13	17154
SBU O-14	13061
SBU O-11	5427
SBU M-10	7882
SBU R-12	6168
SBU S-07	5002

Copies of computer printouts of the calculations used to arrive at these salinity values are attached as Attachment IV.

2. The most recent analyses of water from the "Z-Sand" inside the area for which exemption is requested were obtained from two test holes drilled in the NW/4 of Section 9-T25N-R6E in August, 1984.



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Two samples of the "Z-Sand" water from each test well were analyzed with the following results:

Well:

Lemsco #4

Sample 1. Tested Zone Depth 510-525 ft.  
TDS 3220 Mg/L; Chloride 1593 Mg/L

Sample 2. Tested Zone Depth 510-525 ft.  
TDS 3056 Mg/L; Chloride 1416 Mg/L

Well:

Lemsco #5

Sample 1. Tested Zone Depth 510-525 ft.  
TDS 3740 Mg/L; Chloride 1947 Mg/L

Sample 2. Tested Zone Depth 510-525 ft.  
TDS 3616 Mg/L; Chloride 1770 Mg/L

A copy of the letter transmitting these analyses results is attached as Attachment V to this letter.

The TDS content of the "Z-Sand" water in these two water wells was also determined by Phillips by calculation from the electric logs run on the wells. The results of the calculations were:

Well:

Lemsco #4 "Z-Sand" TDS by Log 2800 ppm

Well:

Lemsco #5 "Z-Sand" TDS by Log 3700 ppm

3. Additional water quality analysis information:

A search of the oil production and saltwater injection files in the area for which exemption is requested turned up some detailed historical water quality analysis data for the "Z-Sand".

Apparently water samples from water producing zones were gathered and analyzed during the drilling of the wells in the NW/4 of Section 15-T25N-R6E, which was known as the Eva Bean lease in the South Burbank pool and is now known as South Burbank Unit "T" Quarter Section, and is in the area for which exemption is requested.

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These wells were drilled in 1934. On all but one well from which sample results were reported, one of the zones from which samples were taken correlates to the "Z-Sand". The Total Solids Content of the "Z-Sand" in each of the wells in 1934 was as follows:

<u>WELL</u>	<u>DEPTH</u>	<u>TOTAL SOLIDS</u> <u>PPM</u>
Eva Bean #2 (SBU T-W02)	590'	3640
Eva Bean #5 (SBU T-05)	600'	3415
Eva Bean #6 (SBU T-W06)	635-650'	5852
Eva Bean #7 (SBU T-W07)	650'	11140
Eva Bean #8 (SBU T-08)	650'	11028

The report from which the above information was taken also shows a breakdown of the concentration of each component of the Total Solids Content. The report containing this detailed information is transmitted with this letter as Attachment VI.

Based upon the foregoing data, a map of the aquifer exemption area is attached hereto as Attachment IX. The area of the "Z-Sand" for which current EPA Region VI data reflects water quality to be between 3,000 and 10,000 ppm TDS is colored in red. The extension of this area for which an exemption is requested consisting of four quarter sections is diagonally lined on Attachment IX. The technical justification for including these four sections in the area for which an exemptions is requested (the area in which water quality is greater than 3,000 ppm TDS, but less than 10,000 ppm TDS) is based upon the data from the Eva Bean Wells.

DEMONSTRATION THAT AQUIFER DOES NOT CURRENTLY SERVE  
AS A SOURCE OF DRINKING WATER

The area for which exemption is requested was surveyed in order to identify any water supply wells which tap the "Z-Sand". Only



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two apparent water wells were located within the area for which exemption is requested. The first well did not tap the "Z-Sand"; in fact, the apparent depth of the well was only six feet. The well is not in use, nor is it in usable condition. This well is located in the SW/SE/SE of Section 2-T25N-R6E. The second well is located in the SE 1/4 of Section 7-T25N-R6E. This was a hand dug well, completed into the bank of Lost Man Creek. The well is not in usable condition. Three other wells are located outside the aquifer exemption area, but within the EPA-specified 1/4 mile buffer zone. These wells, all in the S 1/2 of Section 4-T26N-R6E, are completed into the Hughes Creek Limestone. None of these three wells are in use, nor are they in usable condition.

For a description of all existing water supply wells in the area, refer to the "Shallow Ground Water Survey for North and South Burbank Unit Area" which was transmitted to EPA as Exhibit III to Phillips' letter to the Region VI Administrator dated October 2, 1987. A copy of the "Shallow Ground Water Survey" is also transmitted with this aquifer exemption request as Attachment VII.

DEMONSTRATION THAT INJECTED WASTE WILL REMAIN  
IN THE EXEMPTED PORTION OF THE ZONE

This exemption request is for only a portion of the aquifer, and it is not the intention of the operator (Phillips) to inject into the exempted zone. Because the intent of this exemption request is to allow the operator to maintain fluid levels in injection wells in the area above the exempted aquifer, the following discussion is provided.

As presented in Part II., C., above, a horizon ranging between 900 and 1,000 feet above mean sea level (MSL) is assumed to be the next closest base of USDW. Per the Osage UIC Regulations for inactive injection wells, the operator would be required to maintain fluid levels in these inactive wells below this new base of fresh water. Phillips also seeks authorization to operate injection wells if the fluid levels are kept below the base of such water.

The top of the "Z-Sand" ranges from 460 to 600 feet below ground level over the area. In order to maintain fluid levels below the 100 foot horizon, the "Z-Sand" would be subjected to no more than 360 to 500 feet of head. The potential maximum pressure imposed on the "Z-Sand" would be given as:



Control to : 6W-S  
cc: MDK, LK

GW  
cc: 6A

due 6/30/89



PHILLIPS PETROLEUM COMPANY

6W-1237

May 25, 1989

Environmental Protection Agency  
Region VI  
1445 Ross Avenue  
Dallas, Texas 75202-2733

Attention: Mr. Robert E. Layton, Jr.  
Regional Administrator

Gentlemen:

Phillips Petroleum Company ("Phillips") hereby requests that portions of certain aquifers, here named the "Z-Sand" and the "Happy Hollow" (more specifically described later in this letter), be exempted from protection under the Underground Injection Control ("UIC") regulations for the Osage Mineral Reserve codified at Subpart GGG of 40 C.F.R. §147. The Administrator may designate any aquifer or part of an aquifer as an exempted aquifer under the terms of 40 C.F.R. §147.2908. As will be more fully described later, the area for which the exemption is requested is contiguous with portions of both the North Burbank Unit ("NBU") and the South Burbank Unit ("SBU").

In order to enable the Environmental Protection Agency's ("EPA") review of this Aquifer Exemption Request, the following information will be provided in this letter:

1. Certain general information about the area and the aquifers as requested by EPA.
2. A demonstration that the aquifers do not currently serve as a source of drinking water.
3. A demonstration that any injected waste will remain in the exempted portion of the zones.
4. A demonstration that the aquifers cannot now nor will they in the future serve as a source of drinking water because both are situated at a depth or location which makes recovery of water for drinking water purposes economically and technologically impossible.

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